Protected Permitted Left Turns

Dallas Phasing
and
the 4-Section PPLT Display

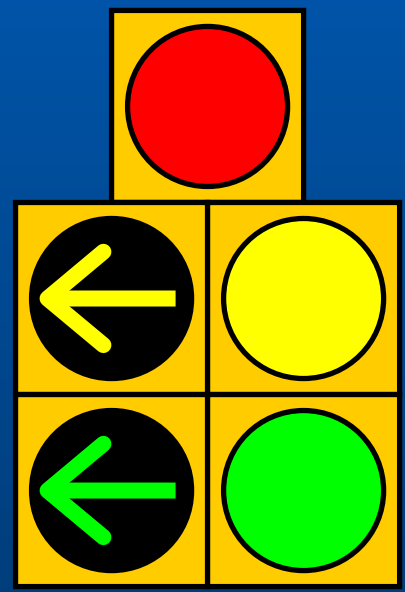
Acknowledgements

- Some of the material in this presentation was provided by researchers from NCHRP 3-54, an FHWA-sponsored research project into protected-permitted left turn phasing.

- Field pictures of Dallas Phasing in Fayetteville were provided by Carl McCartney

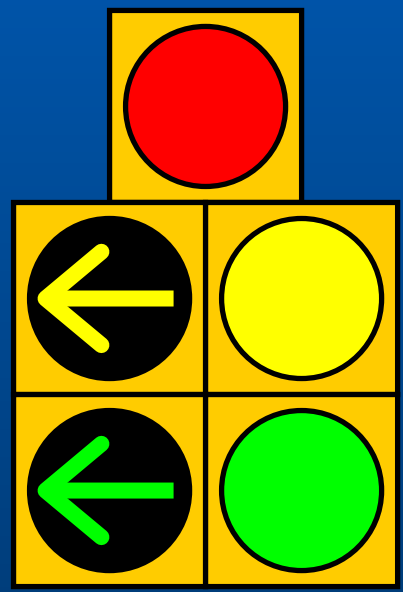
Protected Permitted Left Turn (PPLT) Phasing

- Provides drivers with the option to wait for a protected turn or to make a permitted turn when gaps are available
- This treatment provides for increased efficiency over fully protected left turn phasing
- About 30% of US intersections include PPLT phasing

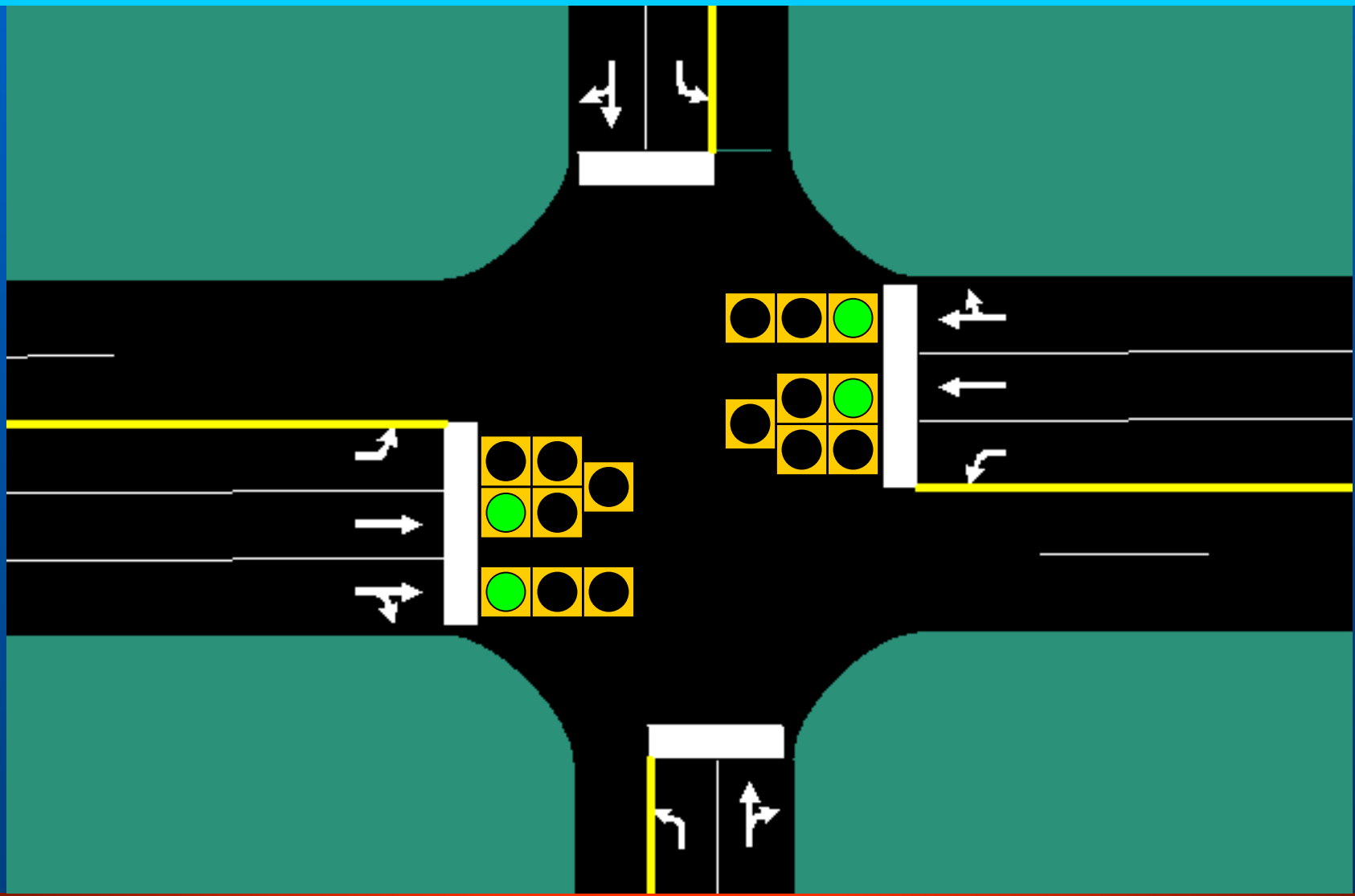


Concerns from PPLT Phasing

- Protected-Permitted phasing can potentially cause a safety issue, often called the “Yellow Trap”
- A yellow trap occurs when a driver waiting to make a permitted left turn sees the adjacent through phase turn yellow while the opposing through phase stays green



The Yellow Trap



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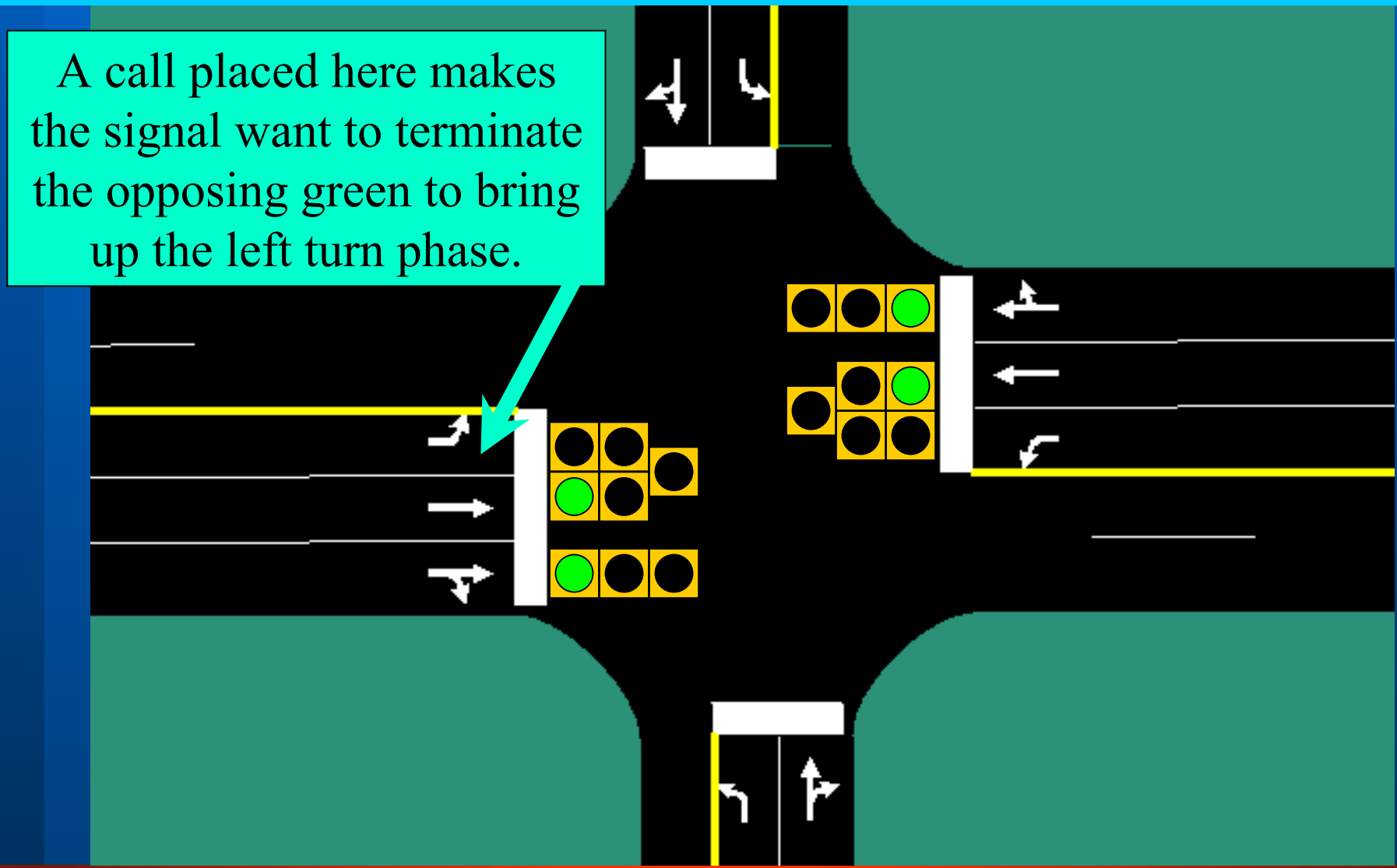

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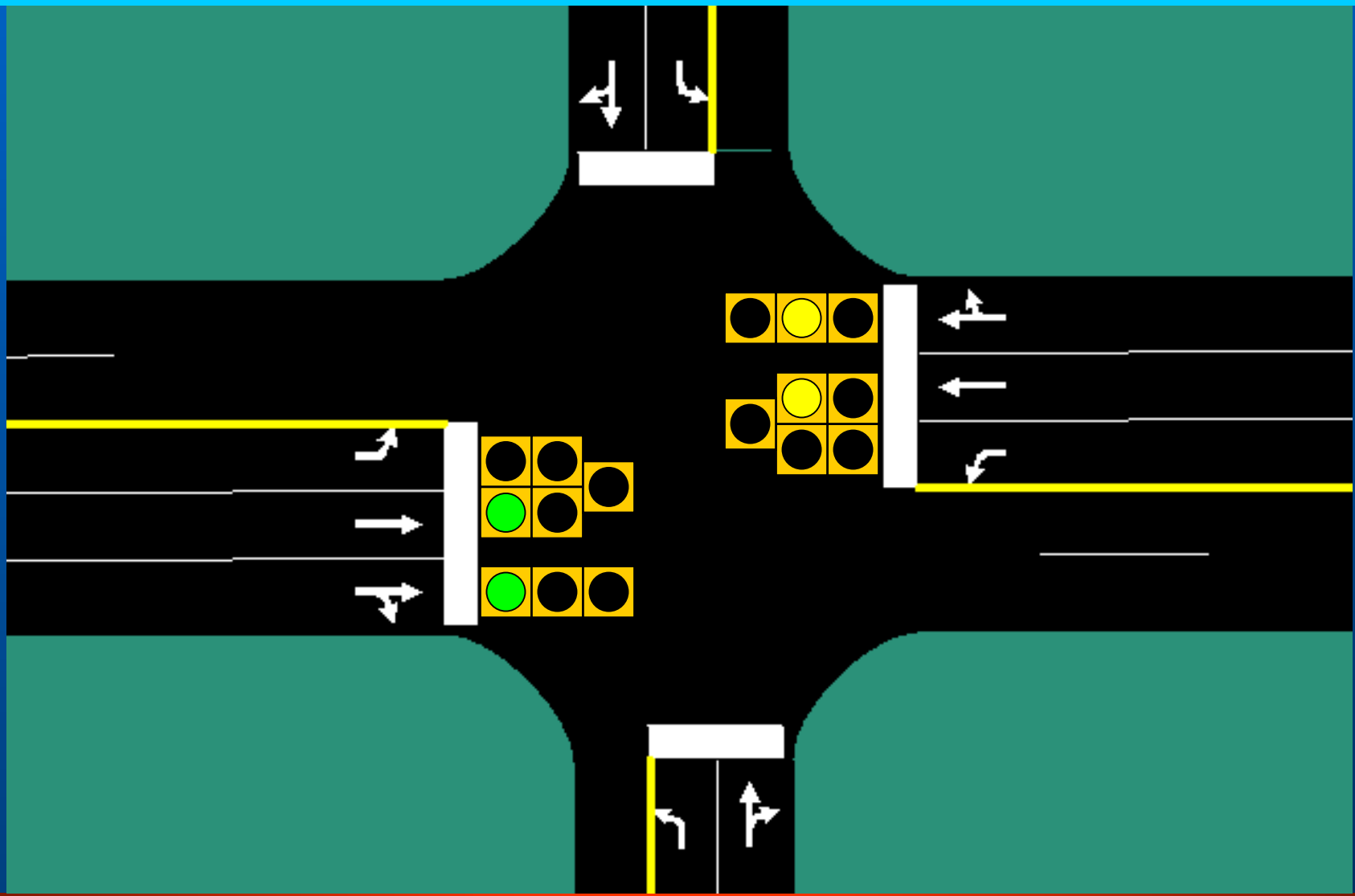

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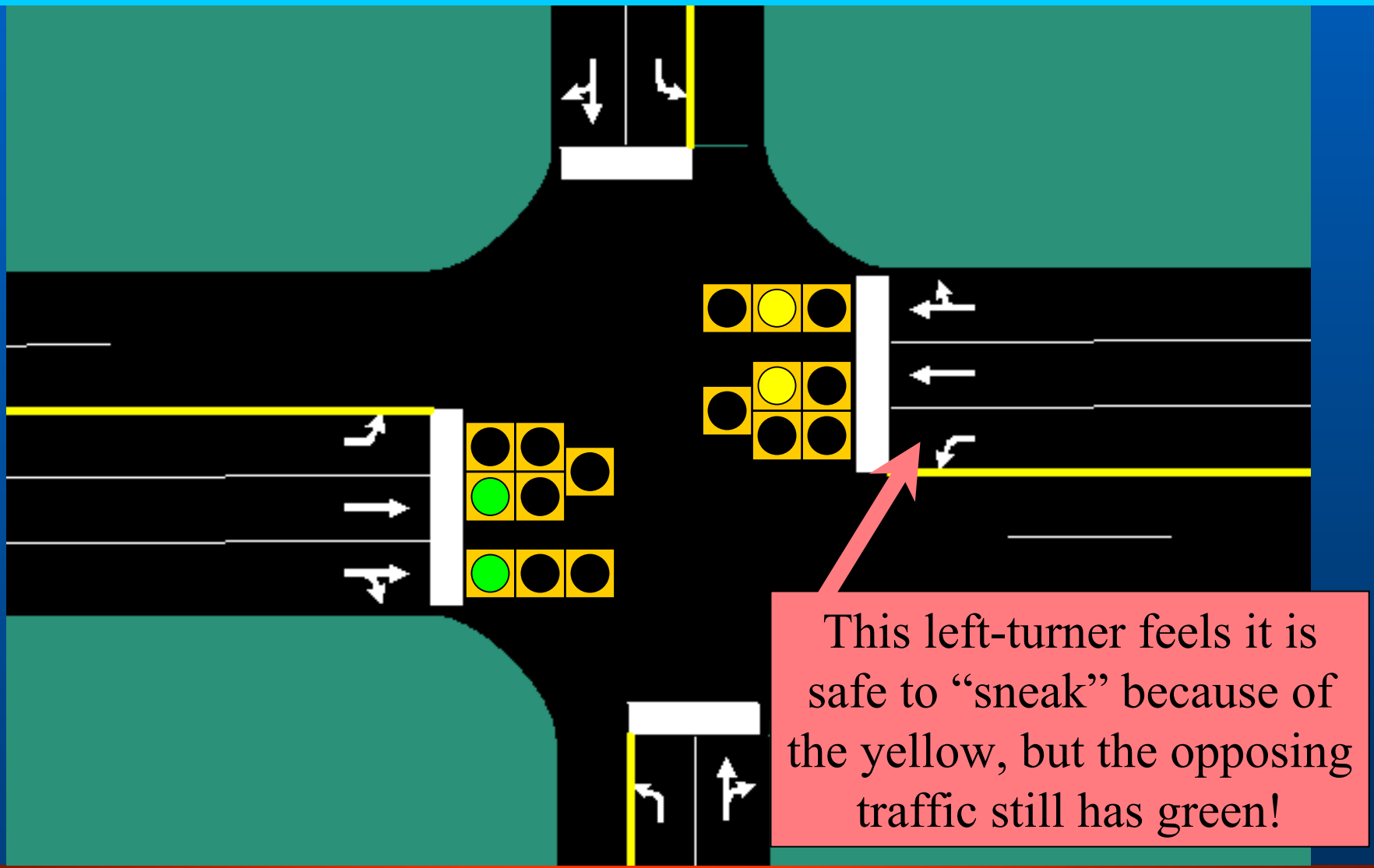


Yellow Trap Animation

Correcting the PPLT Safety Problem

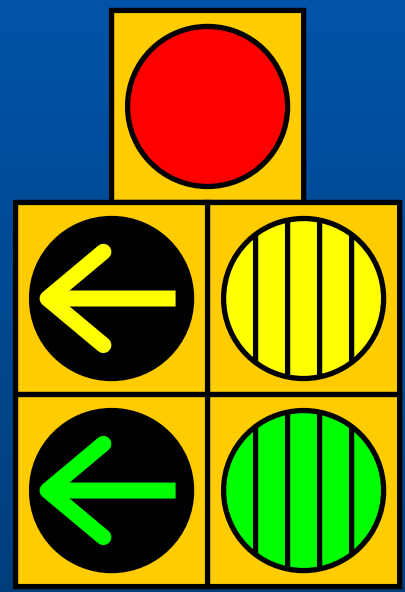
- To prevent the yellow trap from occurring in NC, special wiring or programming is used:
  - When the main street through phases are green, the main street left turn phases are omitted
  - When calls come on the main street lefts, that call is copied to the side street phase, so the controller clears safely from both main street greens simultaneously, serves a min green on the side street, then returns to serve the main street lefts

Correcting the PPLT Safety Problem

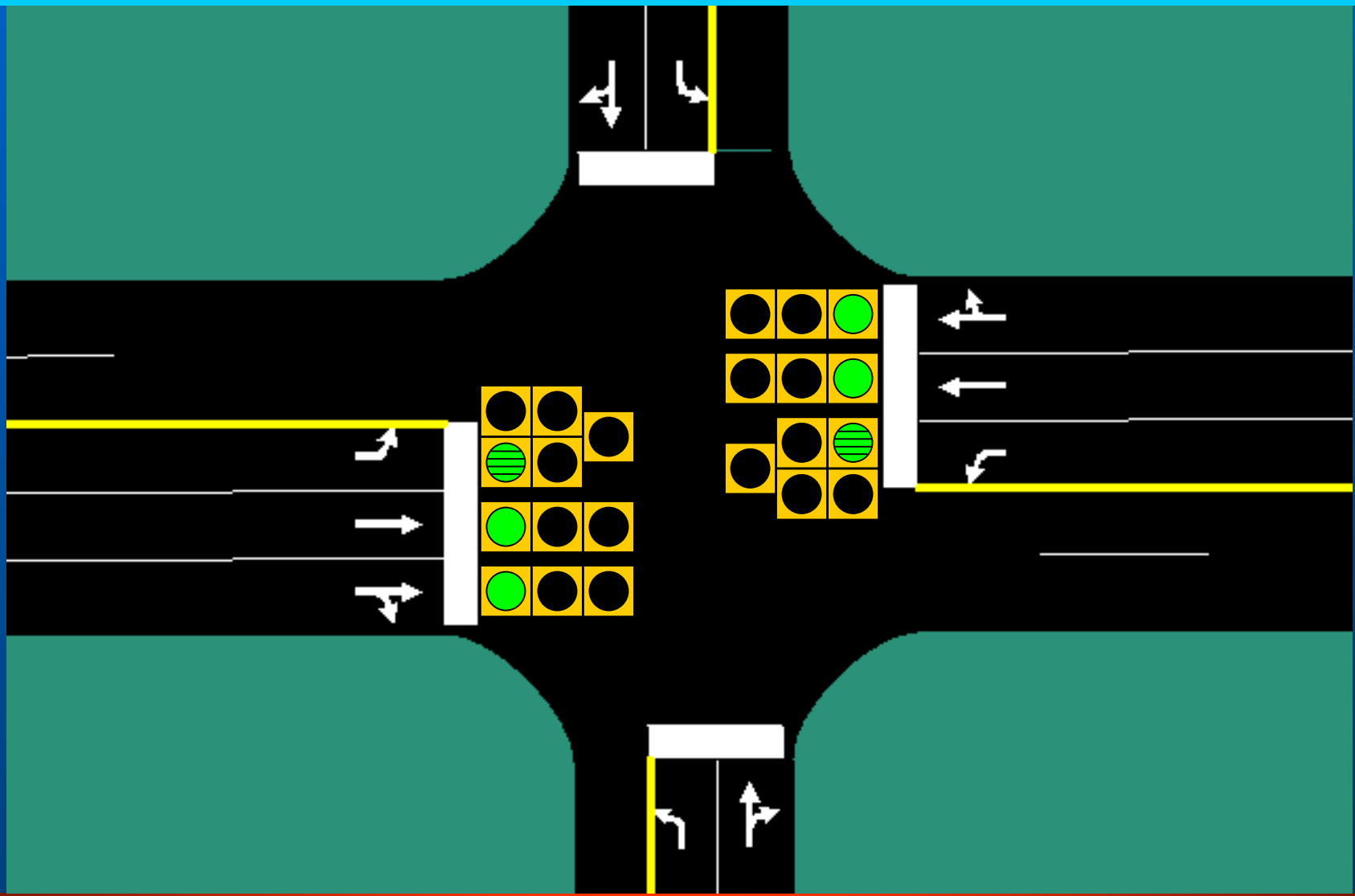
- Unfortunately, this prevention of the yellow trap causes inefficient PPLT operation
  - For one, a side street phase must come up and show a min green and clearance even when no traffic is present. This impacts both isolated signals and coordinated systems.
  - For another, lead-lag phasing is not possible with the phase omit used to prevent the yellow trap. This problem has significant impact in coordinated systems.
- Thus, some of the desired efficiency associated with PPLT phasing is lost

Dallas Phasing

- Dallas phasing makes use of an ***exclusive*** left turn head with louvered green and yellow balls to eliminate the yellow trap without adding inefficiency
- The louvered faces show the ***opposing*** through indication instead of the adjacent through indication to eliminate the yellow trap



Dallas Phasing



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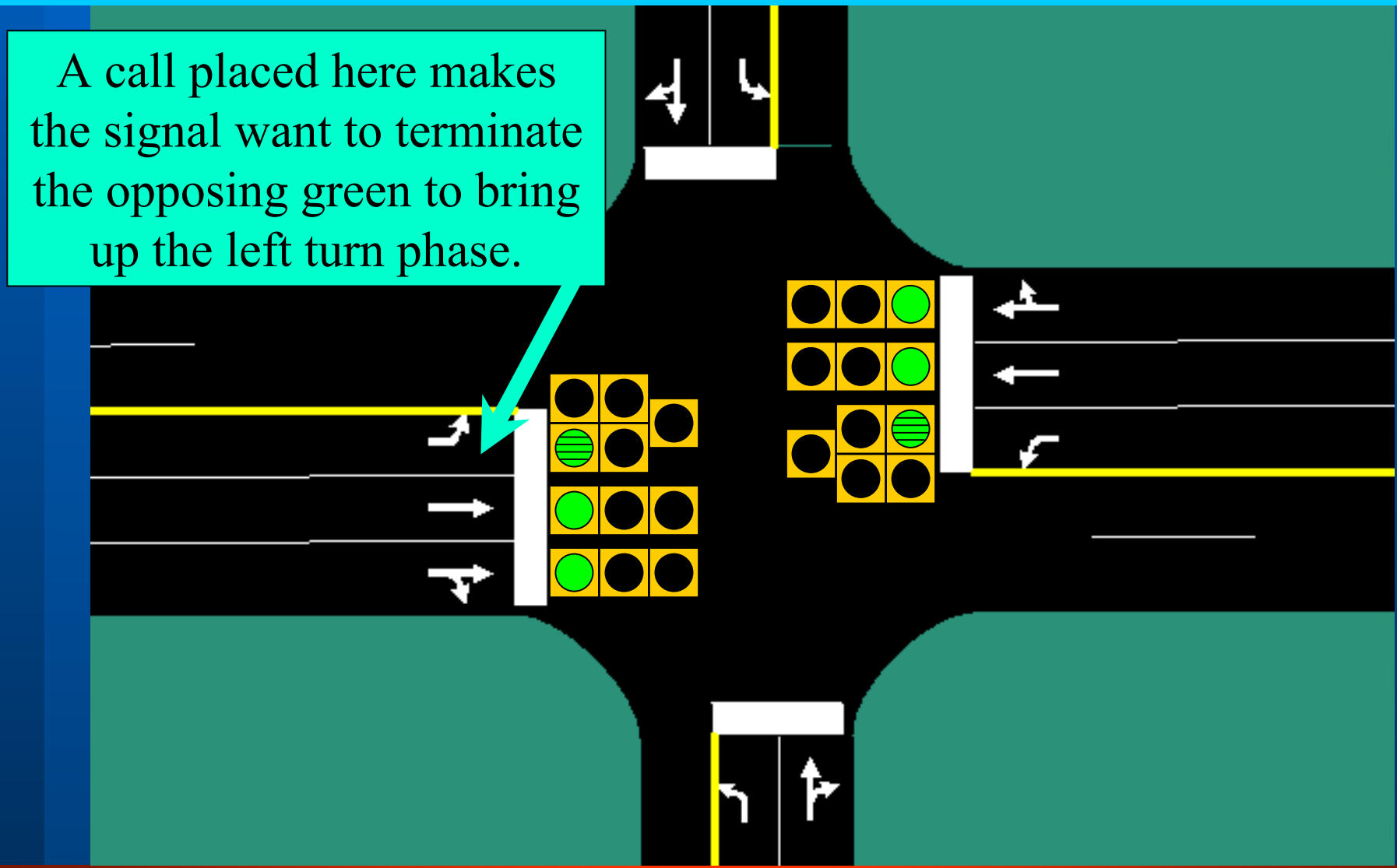

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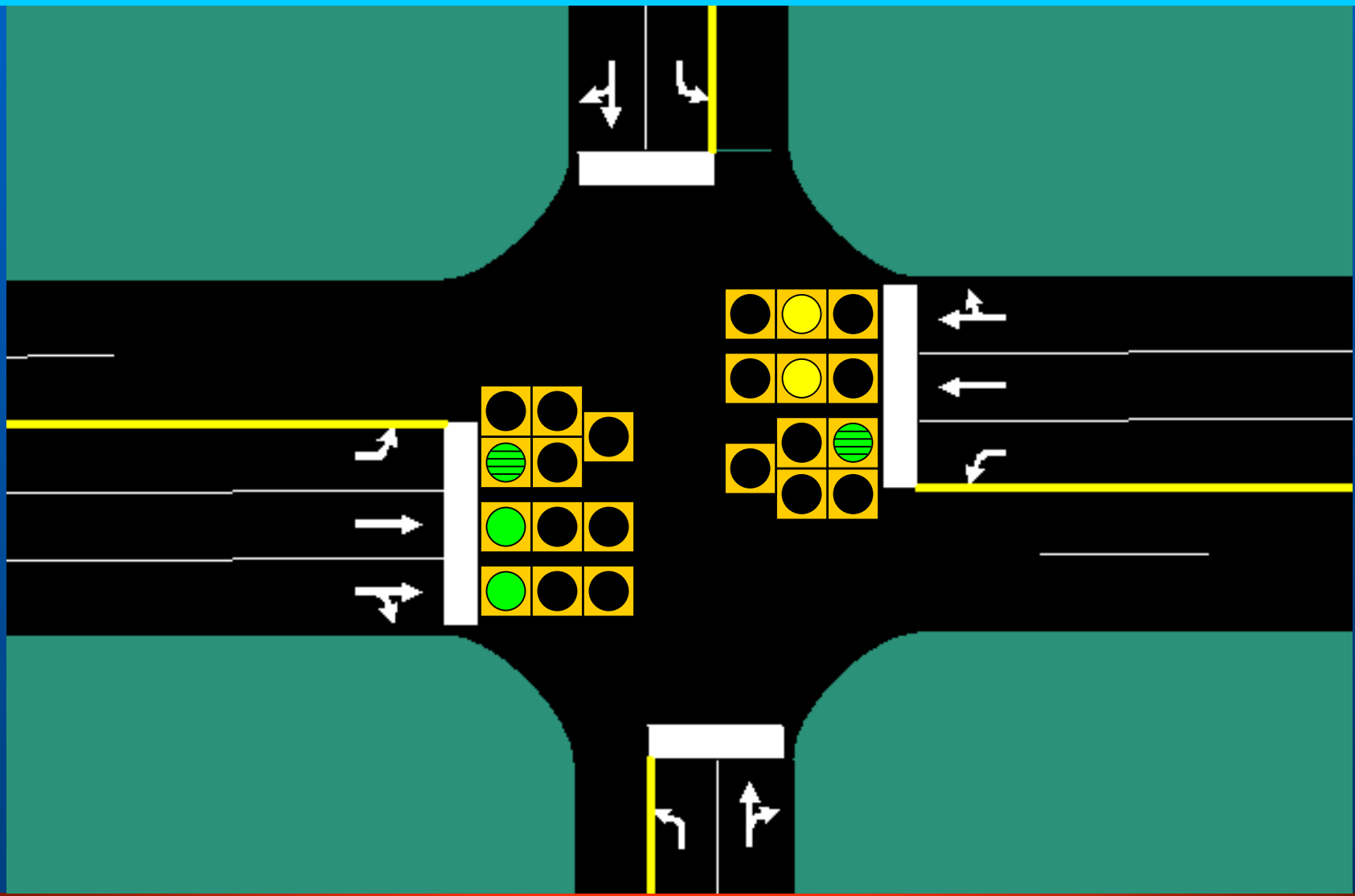

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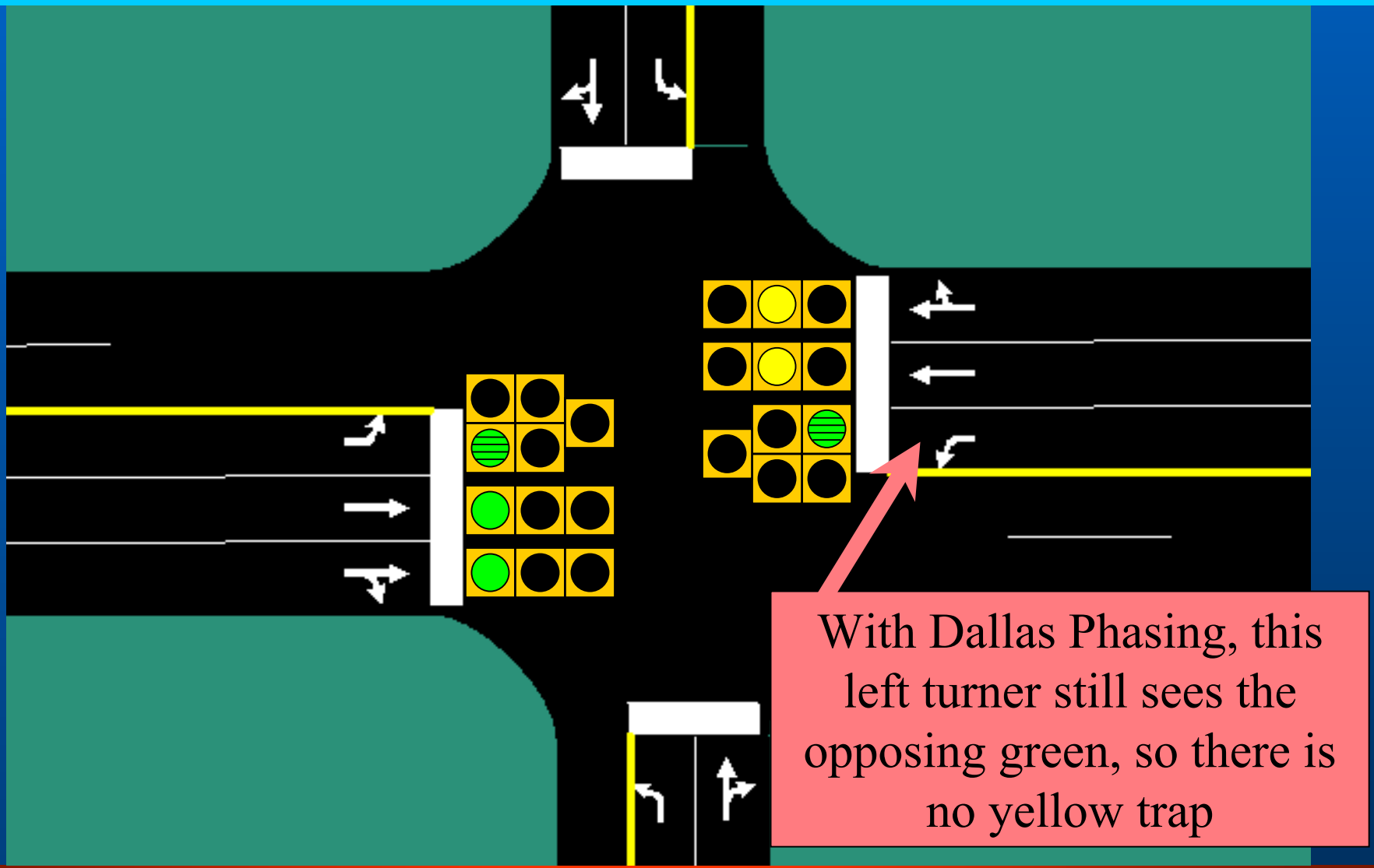
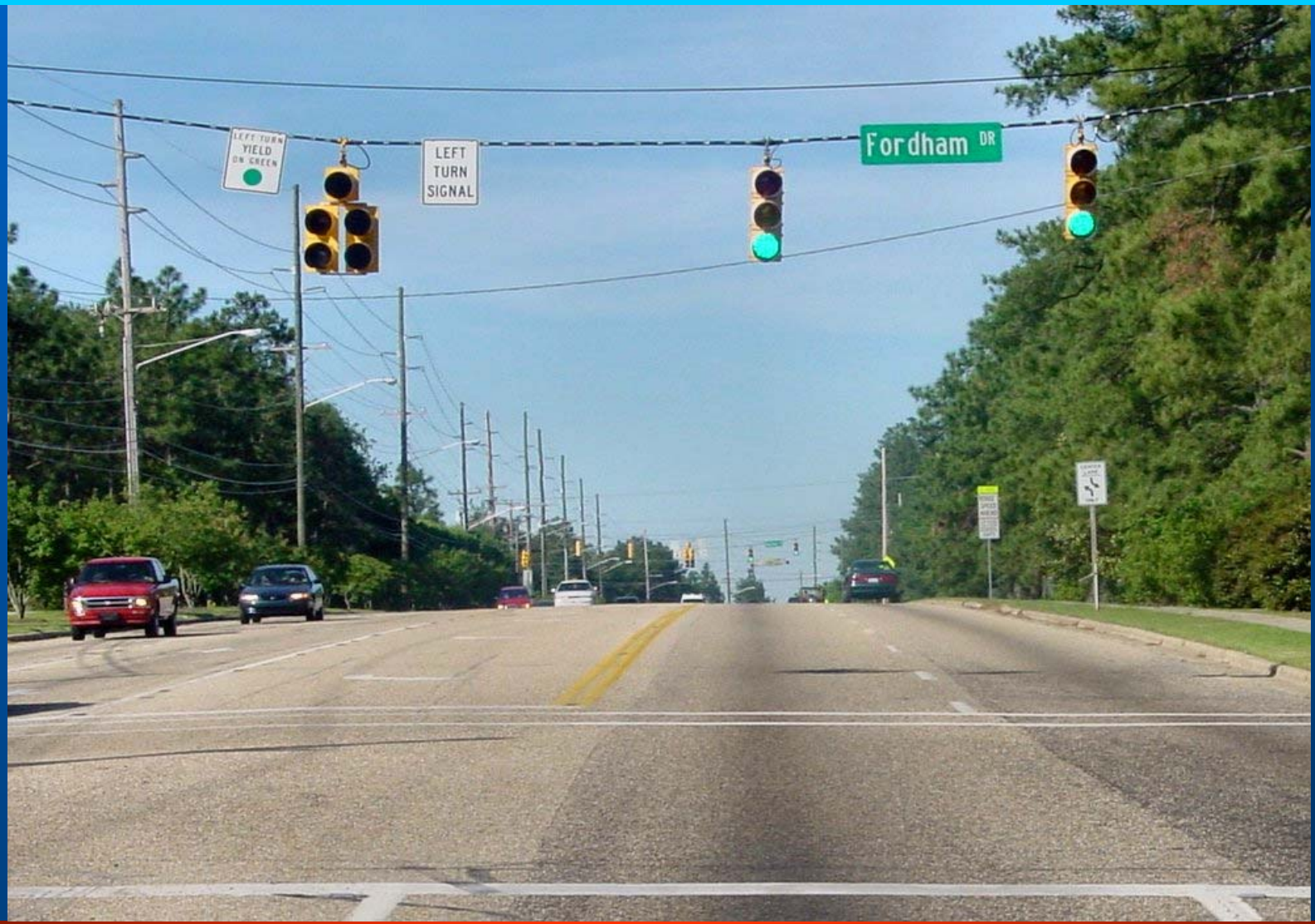


5 – Section Head w/Dallas Phasing

Dallas Phasing - View From LT Lane

Dallas Phasing
Views From the Though Lane (Green)



Dallas Phasing
Views From Through Lane (Yellow)

Dallas Phasing
View From LT Lane (Opposing Thru Green)

Dallas Phasing

- There are only a few minor issues associated with Dallas Phasing
  - There must be a separate left turn head with louvered green and yellow balls
  - The head and louver placement must prevent the adjacent through traffic from seeing green
  - This combination leads to calls indicating a green bulb is out at the location

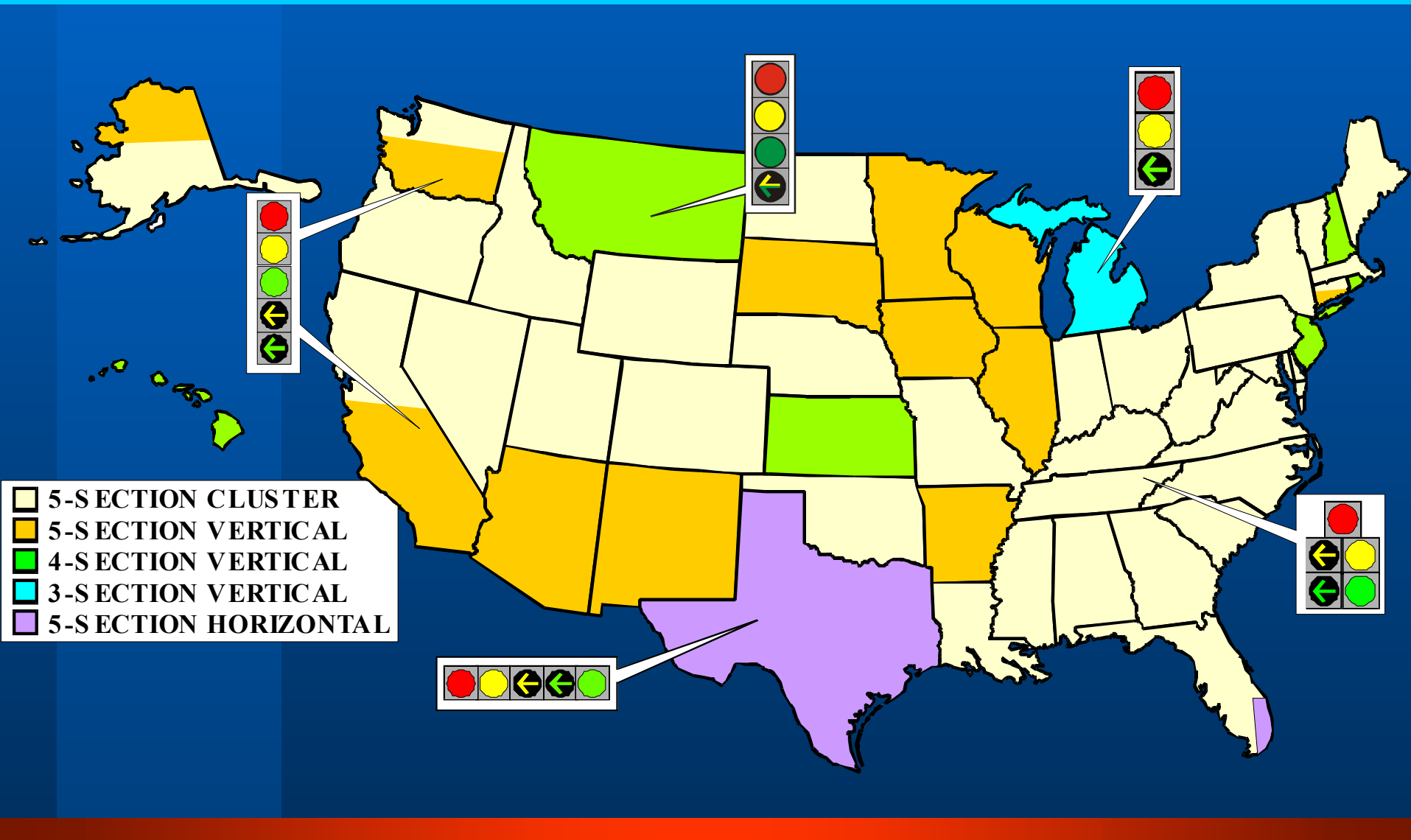
Dallas Phasing Status

- The City of Fayetteville has 2 city signals with Dallas Phasing running in the field.
- NCDOT is willing to review locations for installation of Dallas Phasing
  - Prefer to have mast arm locations to reduce difficulties with louver positioning
  - Prefer sites where anticipated benefit is high
- Currently there is 1 plan in design:
  - 07-1980, NC 68 (Eastchester Drive) at Lassiter Drive in High Point

PPLT Research: NCHRP 3-54

- As noted earlier, FHWA has initiated a research project to investigate PPLT phasing
- The goal of this research was to recommend a new standard display for PPLT phasing
- During the research process, several concerns regarding PPLT phasing arose
  - There is no national standard PPLT display
  - Some of the displays currently used are not allowed by the MUTCD
  - Some of the displays are also confusing to drivers, that is the displays are not intuitive and can lead to accidents

Most Common PPLT Displays



Alternative Permitted Displays

Dallas Display (various locations)

Flashing Green Arrow (Canada)

Flashing Yellow Ball (Seattle)

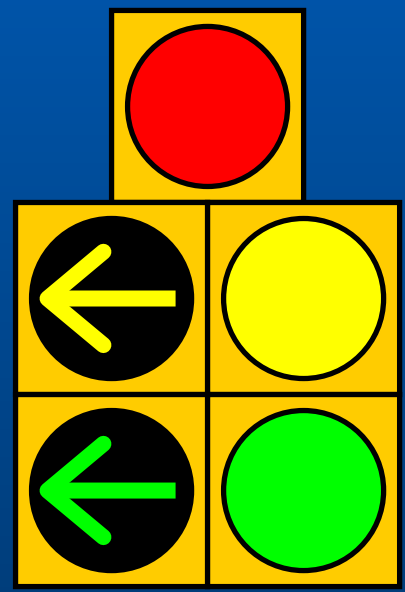
Flashing Yellow Arrow (Carson City, Tucson, Reno, Sparks, Germany, Switzerland)

Flashing Red Ball (MI, MD)

Flashing Red Arrow (DE, Cupertino, CA)

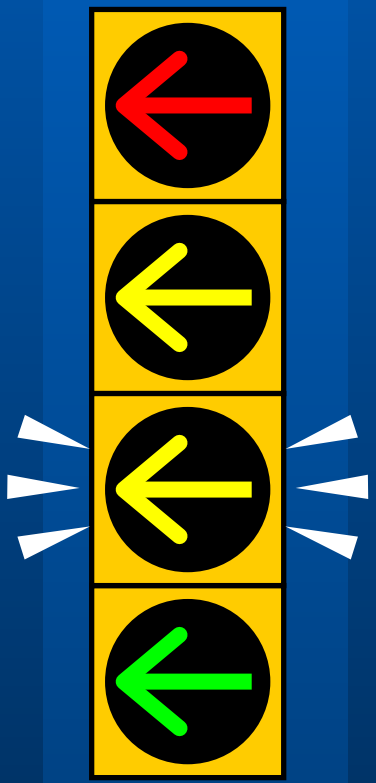
The 5-Section Cluster PPLT Display

- Most common display
  - Used in 34 states (including NC)
  - About 63% of all PPLT displays
- Poor driver understanding in photographic driver testing
  - Incorrect response rate of 29.5%
  - This included a “fail critical” rate of 25%
  - Had the worst performance of all the displays evaluated



Proposed 4-Section PPLT Display

- The researchers have proposed a new 4-section PPLT display:



Solid Red Arrow: Stop. No left turn allowed.

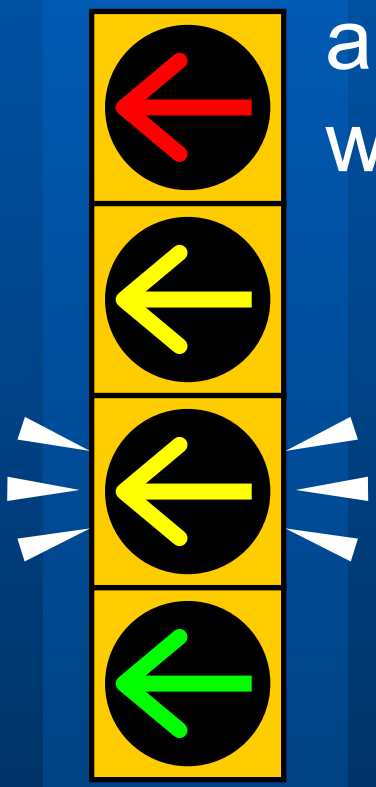
Solid Yellow Arrow: Prepare to stop.

Flashing Yellow Arrow: Left turns allowed, but first yield to oncoming traffic & pedestrians.

Solid Green Arrow: Left turns allowed. Proceed with caution.

Proposed 4-Section PPLT Display

- The flashing yellow arrow provides a clear distinction between when left turning vehicles are protected from oncoming traffic and when they must yield



  - During the permitted move, the display is shown in a different ***location***
  - During the permitted period, the display is shown in a different ***color***
  - During the permitted period, the display is shown ***flashing***

4-Section PPLT Display from Woodburn, Oregon (ODOT)

4-Section PPLT Display Animation

4-Section PPLT Display Status

- The proposed display is currently under review for inclusion in the MUTCD
  - As of December 2002, 16 sites had been approved
  - As of May 2004, 62 sites have been approved
- NCDOT has received approval to install one test site in Raleigh:
  - 05-0905, SR 2911 (New Bern Ave) at Entrance to Wake Medical Center

News Release from Alexandria, VA August 23, 2004

- **Alexandria Replaces Left-Turn Signal with Flashing Yellow Arrow**
  - The City of Alexandria will become one of the first jurisdictions in the United States to replace the left-turn signal light with a new, flashing yellow arrow light. The flashing yellow arrow replaces the circular green indication light that directs motorists who are turning to proceed after yielding to oncoming traffic. The City's Department of Transportation and Environmental Services (T&ES) will begin installing the light within the next 30 days…

We are willing to install!

- NCDOT S&G is willing to pursue installation either Dallas Phasing or the new 4-section PPLT display
  - Prefer locations where the expected benefit is high
- 4-section PPLT still requires exception letter from FHWA.
  - This may slow down implementation